Delivery Accomplishment through Operations Planning

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In the worldwide concrete business, it is common to find that some of the relevant and key elements for customers are product quality and delivery accomplishment; this due to the fact of the customer's project profitability. In this way, the company must assist them with determination in order to base them the factors which make the difference. Nowadays, Argos Colombia has more than 50 ready mixed concrete plants, 500 truck fleet, 70 pumping equipment and an annual production and distribution capacity close to 4'000.000 m^3; this is done under high world class quality, productivity and accomplishment standards, leading the concrete business in Colombia. All of this is based on the inclusion of an operation planning methodology; it is considered as a working philosophy, ensuring that customer's needs and expectations are completely aligned with the business and the value proposal for clients.

This document presents how the business planning model is based on a logistic model which unifies demand planning (short, medium and long term), raw material supply, production plan and equipment allocation (concrete production, distribution and delivery); it is supported by technological tools and a plant master plan. It guarantees successful results in the delivery accomplishment.

The operations planning process in Argos comes from the intrinsic necessity to fulfil the main business standards:

- To optimize Argos operation and distribution
- To optimize the products quality
- To make the business grow, increasing its profitability

From these starting challenges, some questions appear: How many plants should be opened in order to supply the market? What is their capacity? Where should they be located? How many cars per plant? How to optimize my programing curve in order to respond the maximum volume with the minimum of resources? How to plan the stock and repositions? Could we assure all the resources to respond to the market? How should the plant layout be in order to optimize the cycle? How to simplify our processes? What is the scheduling limit? What should our service promise be? How do we guarantee an optimum service level when eventualities occur? How to measure efficiency?, etc.

In order to solve all of these questions and become more internally and externally efficient, a labour was started focused on the definition of a working methodology based on a solid operations planning process. Efficiency seems internally as the maximum use of the resources in order to be more profitable and to grow in the market; efficiency seems externally as resources management and control, overcoming the customer expectations in order to guarantee their satisfaction and loyalty. Operation planning has two solid pillars as a philosophy: the logistic model and the plant master plan. These concepts are developed through the study of the best operational practices and models. This is done in order to reach the highest efficiency performance of the resources, the accomplishment of the quality, client service and productivity standards defined by the business.

The logistic model unifies the operations planning process (Figure 1). It brings together variables and concepts which are necessary for an efficient short, medium and long term resources planning to supply, produce and deliver concrete. The constant operation monitoring is strengthened through programming centers and cutting edge technological tools for real time adjustments. Different operations areas take part in this model: raw material, quality control, production, dispatching, maintenance and commercial teams. It establishes the regulations and optimization tools in order to accomplish the business standards.

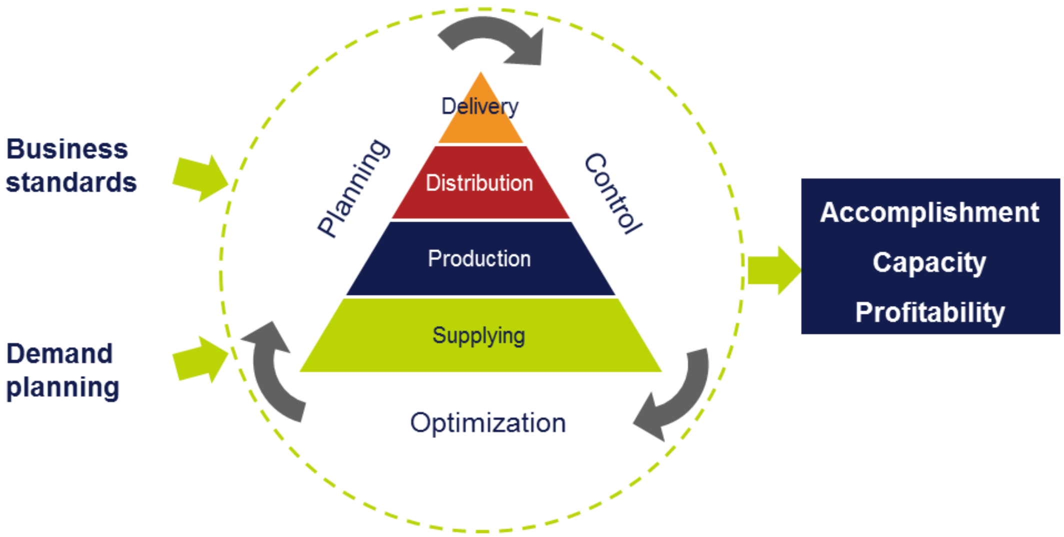

Figure 1

The plant master plan establishes the standard mix design considerations for each ready mixed concrete plant. It is based on an unified flow optimization and infrastructure considering location efficiency, capacity, an integrated marketing image and environment commitment. It determines the plant layout which will accomplish the previous considerations (Figure 2).

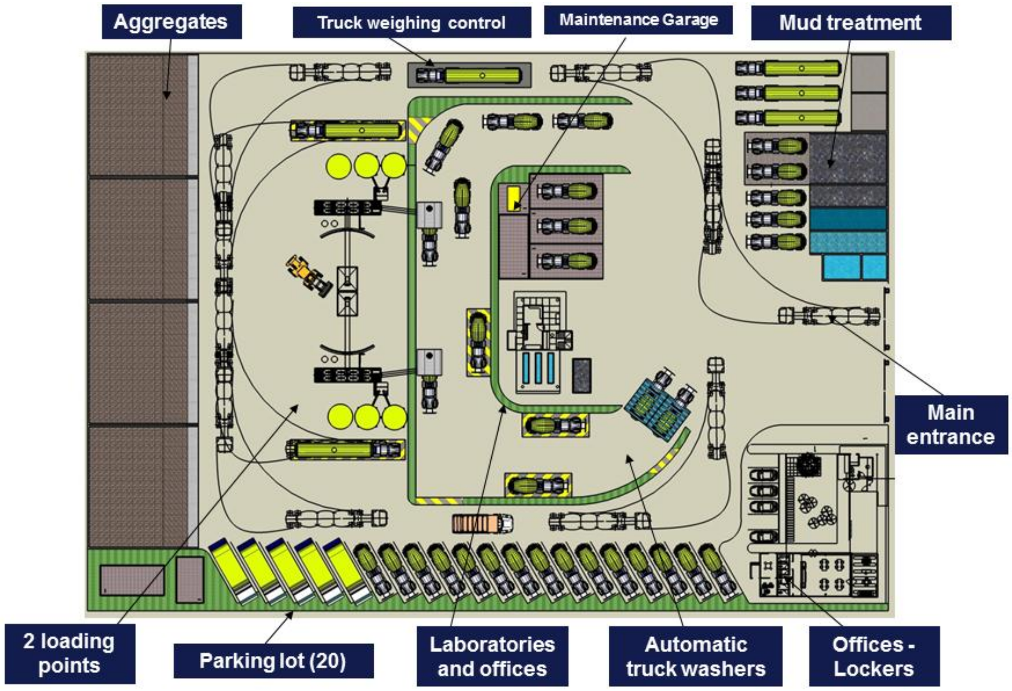

Figure 2

The operations planning process was applied in Concretos Argos Colombia based not only on these pillars but also on a Logistic Planning Area and focusing on the business standards accomplishments. It is applied along this country (4 zones) considering the following supporting stages:

1) Demand planning

It represents the company sales objectives (m^3). It must be done considering three perspectives:

- Long term: it is a demand estimation which is developed for a year or more. It must consider the volume based on the market participation and a projected growth; it could be supported by specialized studies which find the business potential, focusing the sales force and excelling the investments. It covers regions and cities.
- Medium term: it is a budget which is adjusted to the market reality; it is supported by the real and potential sales of the company. The period goes from one month to a year with a continuous month tracking to guarantee the best assertiveness. The decisions to invest in resources for the company are based on this. It includes even each ready mixed concrete plant.
- Short term: the planning period is from 1 day to 30 days. This type of planning is the closest one to a real demand. It considers even the plant load point; at this stage, resources are programmed in order to execute company sales.

2) Long term logistic modeling

There are two main key components for a long term modeling: a historic and future component. The historic component is obtained from the real concrete dispatching data base; from this information Concretos Argos visualizes volume, location and market tendency per each city. The future component comes from both, a long term demand planning and studies of different specialized companies focusing on house, commercial, industry and infrastructure concrete building activity; these studies identify the concrete market in the main cities in 5 years and how it is distributed per zone and density in cubic meter units. After analyzing these two components together, location and long term ideal size of the plant are selected; growth variables, location tendencies and territorial organization plan are considered for this selection. These parameters were checked in real concrete operations and they have been applied for each new operation.

3) Production installed capacity

Ready mixed concrete plants capacity is defined based on average distribution cycle time and the expected volume. These parameters will be calculated in terms of maximum available mixers to operate efficiently; it means a minimum tail and dead time in the loading waiting process and cubic meters per hour of production. It is calculated in both existing plants and future ones depending on the required volume for production.

After having the maximum mixers number which delivery efficiency is high, these capacities could become m^3/h of concrete. Depending on the production journeys, these capacities would also be converted in day, month and year. The following equation describes the capacity calculation:

$$T_C = \left(\frac{CP \times 60}{V_C}\right) + Tp$$

$$Mx = \left(\frac{RT}{T_C}\right) \times Fo$$

$$Mx = \left(\frac{RT}{\left(\left(\frac{CP \times 60}{V_C}\right) + Tp\right)}\right) \times Fc$$

$$C_R = \left(\frac{Mx \times CP \times 60}{RT}\right)$$

RT=Journey period (min)
Mx=Mixers number
Vc=Loading point velocity (m^3/hour)
Tp=Period between loadings (min/load)
Fo=Coverage factor (70%)
CP=Average load (m^3/journey)
Tc=Period to load a mixer (min/journey)
C_R=Production Capacity (m3/hour)

This equation was validated using a software developed to simulate the mixers movement around a virtual track; it was modeled using similar random cycle periods which occur in each region. There were some evident results after modeling different scenarios with a different number of mixers (lower, higher or equal to the plant capacity), the same velocity conditions and loading and average cycle time. Less tail time in each plant and higher production efficiency (m^3/h) were obtained with a lower or equal capacity; this occurs when it is compared to the limit one. The limit of concrete production programming is obtained from this daily capacity; it is described in the following equation:

$$Lim_p = \left(\frac{C_{Rd}}{1 - \%C}\right)$$

Lim_p = Programming limit (m^3/day)

C_{Rd} = Real production capacity

%C = Cancellation percentage

4) Layout optimization

The optimization process must be considered with an efficient plant model; from this the following operative conditions can be highlighted:

- Mixer and loader lanes will be separated to each other
- Mixers lanes will have the highest priority over any other.
- Every ready mixed concrete plant will have its own mud and recycled concrete compartments.
- There will be a maintenance zone in each plant.
- Automatic truck washer will be included in the plant.
- A minimum of 3 day stock will be the capacity of the raw material zones.
- Mixers must not return to the mud washing zone after passing the loading point.
- Pipes and dump trucks could go back just in special circumstances without interfering in the mixers lane.
- Plants will have a parking lot for the mixers.

As a complement to the plant master plan, it was developed a pilot real scale model for the ideal ready mixed concrete plant; it was done with the objective of finding possible mistakes and future design improvements. As a result of this exercise, the model efficiency and the conditions accomplishments were evident. The principles of the plant master plan were applied to every operation in order to optimize the internal flow and cycle time reduction. Some special changes were made to the existing plants to accomplish the "Ideal Layout".

5) Supply planning

Based on the demand planning, the necessary raw material resources are projected in order to supply all the concrete production in long, medium and short term. In this way, the raw material consumption amounts are defined. The supplying areas determine the resources of their own production plants in order to accomplish with the established time, quality and amounts. It is performed considering the following scheme:

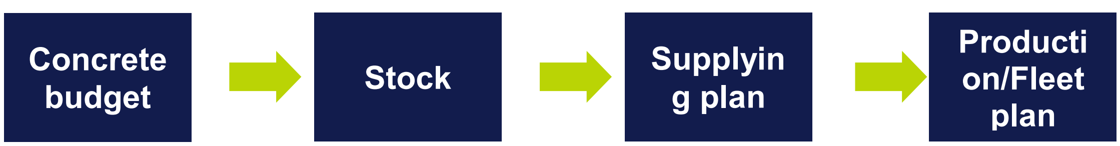

Figure 3

This plan is consolidated with a detailed quantity, product, supplier per loading line and stock day depending on the stock capacity and consumption. The execution is measured by volume, time and origin–destination indicators. Maximum and minimum stock alerts have been created with some others such as reorder point, optimum quantity and order frequencies.

6) Equipment assignation

The equipment necessities for the production, distribution and delivery are planned in the long and short term; it guaranties the infrastructure resources which must be bought and introduced in the operations in order to support the planned demand. The fleet distribution is considered in the short term between the four regions in order to accomplish with the distribution and delivery according with the adjusted sales budget. The fleet supports the whole country which means that trucks will be located where the main necessities are presented. Five main assignation concepts are considered according with the following diagram:

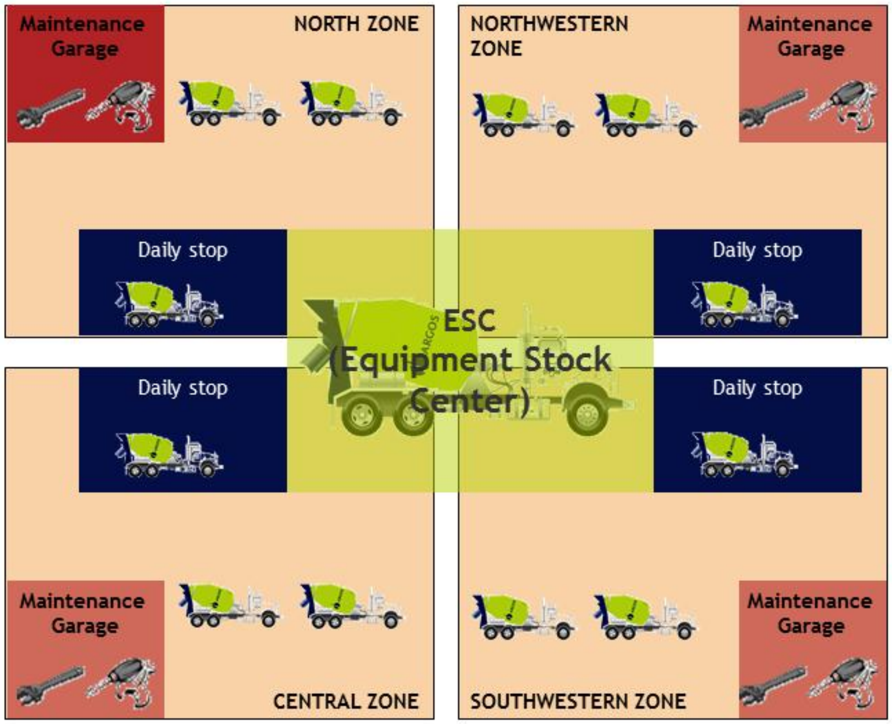

Figure 4

- Equipment Stock Center (ESC): It is a national stock which is about 1% to 2% of the total fleet and it is ready to be part of the operations. They will be used as a backup plan depending on the operations or an unexpected demand growth, etc.
- Equipment in the maintenance garage represents 5% of the fleet and it is committed with minor interventions or as a preventive option. The main objective is to assure the 95% of the fleet.
- Operative equipment: It is the total fleet minus the equipment in the maintenance garage and the ESC equipment. This equipment is ready to be activated at any moment.
- Active equipment: This equipment is activated for concrete delivers using the following calculation:

$$Mxa = \left(\frac{Vp \times (1 - \%C)}{Pd} \right)$$

Mxa = Equipment to be activated
Vp = Programmed volume (m^3)
%C = Dispatching cancelation (%)
Pd = Productivity goal (m^3/day)

- Daily stop: This operative equipment is stopped by productivity and it depends on each regional efficiency. It is the difference between the operations equipment and active equipments.

7) Monitoring and production plan

These two stages are conducted through the Programming and Dispatching Centers implemented in the country; these centers are located in the main cities of each region (Bogotá, Medellín, Cali and Barranquilla). From these cities the attention customer process takes place through phone call orders; these concrete orders are programmed and dispatched under one high level specialized tool (Command). Every center operates under the following considerations:

- All the calls come to one unique national line.
- There are applied the methodology and unified practices of the concrete programming logistic model. The plant programming limits, daily equipment activation and productivity stop are considered.
- Functions and specialized responsibilities are focused on customer service; programming is focused on reception, programming and order modifications. Dispatching is focused on the programming plan execution and fleet cycles tracking.
- Standardized call reception protocols
- Constant coordination between the ready mixed concrete plant and supporting areas (quality, maintenance, commercial, logistic, raw material supply, etc). It will assure an efficient programming execution.
- Service quality indicators (*90 in 20* calls). Continuous monitoring of the information quality, call lasting and abandoned calls.
- Service delivery guarantee between +/- 20 minutes of the programmed hour.
- Policies and reception schedules of the programming accepted by the customer.

8) Results measurement

The operations planning process started in January 2009; from this moment, the delivery accomplishment and satisfaction level have been measured and controlled as the main priority; this is supported by productivity indicators to assure equipment efficiency and performance based on clear national objectives (Table 1).

KPI	Description	Objetive
Delivery accomplishment	Volume percentage that accomplished with the arriving range time (+/- 30 minutes from the programmed hour).	95%
Service level	Calls answered before 20 seconds (from the calls total number).	90%
Productivity (m^3/h)	Minimum concrete cubic meters which can be delivered by a truck in an operational hour	2

Table 1.

9) Optimization

Optimization is a constant in the logistic model; this is due to the operational continuous movement and changes, and the everyday customer expectations increment. Improvement projects are started continuously, developing new tools and introducing new technologies which make easier the daily operations. These new technologies help to accomplish the business standards increasing the profitability, operational efficiency and the customer satisfaction.